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ELEVENTH
BIENNIAL REPORT

OF THE

*Montana State Board
of Horticulture*

FOR THE YEARS
1919-1920



STATE *of* MONTANA

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STATE *of* MONTANA

Montana State Board of Horticulture

HON. SAMUEL V. STEWART
EX-OFFICIO MEMBER, HELENA

W. J. CRISMAS
FIRST DISTRICT, JOLIET

T. T. BLACK
SECOND DISTRICT, WHITEHALL

ALLEN PIERSE
THIRD DISTRICT, GREAT FALLS

FRED T. PARKER
FOURTH DISTRICT, MISSOULA

O. M. GERER
FIFTH DISTRICT HAMILTON

ARTHUR V. PLATT
SIXTH DISTRICT, BIG FORK

C. C. WILLIS
SEVENTH DISTRICT, PLAINS

FRED T. PARKER
PRESIDENT

J. C. WOOD
STATE HORTICULTURIST

LAURA B. ELLITHORP
SECRETARY

OFFICE, CHAMBER OF COMMERCE BUILDING, MISSOULA

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LETTER OF TRANSMITTAL

Office of the State Board of Horticulture,
Missoula, Montana, January 1, 1921.

*To His Excellency, Joseph M. Dixon, Governor of Montana, and
To the Legislative Assembly of the State of Montana:*

In compliance with the provisions of Section 1932 of the Revised Codes of 1907, amended by the Twelfth Legislative Assembly, I here-with submit the Eleventh Biennial Report of the State Board of Horticulture covering the years 1919 and 1920.

Respectfully,
J. C. Wood,
State Horticulturist.

ELEVENTH BIENNIAL REPORT

RECOMMENDATIONS.

In the budget submitted to the State Accountant, as required by law, found on page 6 of this report, an increased appropriation is asked for. We know that this will be necessary to adequately guard and take care of our horticultural interests. In 1911 the appropriation granted us by the Legislature was \$13,500.00, which included \$2,500 as salary for the State Horticulturist, and since that time we have had one increase of \$500.00. During these ten years fruit growing has become one of Montana's leading industries and our commercial apple production has increased more than fourfold; also our expenses, such as traveling, inspection, labor, material, and supplies of all kinds. The enforcement of all quarantine regulations, three of which are now in effect, has been placed with the Board. In 1919 we expended \$1,000 on the eradication of the harmful barberries, but were unable to follow up the work in 1920 on account of lack of funds. If the quarantine against the alfalfa weevil is not rigidly enforced, it will bring disaster to the alfalfa growers of this state, and our present appropriation is inadequate to fully comply with its requirements.

The codling moth is being allowed to become established in the commercial fruit sections of the state on account of lack of funds to enforce its control. The Colorado leaf-roller has made its appearance, and already has resulted in great damage, and unless its ravages are checked bids fair to destroy the fruit industry of the Bitter Root valley, and our funds are insufficient to enforce control measures.

Our horticultural law was framed to suit conditions as they existed at the time it was enacted, but new problems have arisen, and in order to meet them our law should be so amended as to give the Board power commensurate with its added responsibilities. The question of the horticultural law will be taken up and discussed by the fruit growers at the annual meeting of the Montana Horticultural Society, to be held in Hamilton this month, at which time a committee will be appointed to recommend constructive changes.

We bespeak for the recommendations of this committee the consideration due its members as representative fruit growers who know from practical experience and close study the needs and conditions of horticulture in Montana.

ELEVENTH BIENNIAL REPORT

ESTIMATED BUDGET

For

MONTANA STATE BOARD OF HORTICULTURE

	1921	1922
GENERAL ADMINISTRATION	*\$34,800.00	*\$34,800.00
OPERATION	* 31,850.00	* 31,850.00
Salaries	* 21,300.00	* 21,300.00
State Horticulturist	3,000.00	3,000.00
Secretary	1,800.00	1,800.00
Inspectors	16,500.00	16,500.00
Office Supplies and Expenses.....	* 1,650.00	* 1,650.00
Postage	300.00	300.00
Stationery, Record Books and Blanks....	800.00	800.00
Sundry Office Supplies and Expenses....	300.00	300.00
Telephone, Telegraph	230.00	230.00
Express, Freight, Drayage.....	20.00	20.00
Traveling Expenses	* 4,500.00	* 4,500.00
State Horticulturist	1,500.00	1,500.00
Inspectors	2,700.00	2,700.00
Board Members at Meetings.....	300.00	300.00
Printing and Binding Publications.....	600.00	600.00
Spraying	2,500.00	2,500.00
General Supplies and Expenses.....	300.00	300.00
Quarantines	1,000.00	1,000.00
CAPITAL EXPENSES	* 2,850.00	* 2,850.00
Furniture and Furnishings.....	200.00	200.00
Machinery and Appliances.....	2,500.00	2,500.00
Hand Tools and Petty Equipment.....	150.00	150.00
REPAIRS AND REPLACEMENTS	* 100.00	* 100.00
Machinery and Apparatus	100.00	100.00

*Group Totals.

	INCOME	ESTIMATED	
		1921	1922
Appropriation Horticultural Board Expenses.....	\$20,000.00	\$20,000.00	\$20,000.00
Collections State Horticulturist.....	10,000.00	10,000.00	10,000.00
Net Appropriation and Collections Used.....	\$30,000.00	\$30,000.00	\$30,000.00
Appropriation Salary State Horticulturist.....	3,000.00	3,000.00	3,000.00
Appropriation Salary Secretary.....	1,800.00	1,800.00	1,800.00
	<hr/>	<hr/>	<hr/>
	\$34,800.00	\$34,800.00	\$34,800.00

PRESENT HORTICULTURAL CONDITIONS

The horticultural law divides the state into seven horticultural districts as follows: The first district comprising the counties of Dawson, Custer, Yellowstone, Sweetgrass, Park, Carbon, and Rosebud; the second district comprises the counties of Gallatin, Madison, Beaverhead, Silver Bow, Lewis and Clark, Meagher, Wheatland, and Broadwater; the third district comprises the counties of Cascade, Fergus, Valley, Chouteau, Teton and Musselshell; the fourth district comprises the counties of Missoula, Mineral, Granite, Powell and Deer Lodge; the fifth district comprises the county of Ravalli; the sixth comprises the counties of Flathead and Lincoln; and the seventh the county of Sanders. Counties formed since the law was enacted all remain in the district which included the original county.

The Board of Horticulture, which is charged with the administration of the horticultural law, is appointed by the Governor, one member from each district for a term of four years and all serving without pay. The governor is ex-officio a member of the Board. The members from the various districts are chosen for their practical experience in fruit growing and their interest and study in horticultural problems.

The regular meetings of the Board are held on the third Monday in February and September and special meetings may be called when matters of importance are to be considered.

The executive work of the State Board of Horticulture is under the direction of the State Horticulturist who is selected by the Board.

Fruit Inspection.

All fruit entering the state or produced within the state is subject to inspection with the exception of blackberries, cranberries, currant, gooseberries, loganberries, raspberries, strawberries, bananas and pineapples. Melons, cantaloupes and tomatoes are also exempt from inspection. In so far as it is possible to do so, fruit is inspected at the distributing centers and at point of production. Butte, Helena, Great Falls, Billings, Havre, and Missoula are the points at which the greatest amount of incoming fruit is inspected. At these places carloads are received from the western states and distributed to nearby points. In the Bitter Root valley, the Missoula valley, the

Flathead lake section and parts of Carbon county locally produced fruit is inspected for pests and diseases before it is shipped. The railroads are forbidden by law to accept fruit for shipment before it has been inspected and passed as reasonably free from dangerously injurious pests and diseases. The inspection of fruit should be maintained in Montana with such thoroughness that new pests and diseases will be kept from the fruit sections just as long as possible and in such manner that the consumers will be protected from inferior and worthless fruit.

Nursery and Nursery Stock Inspection.

The setting of fruit trees has been very small with the exception of home orchards. Very few commercial orchards have been planted within the last ten years, consequently only the older and well established nurseries are still operating. Nurseries within the state are inspected yearly and if the stock is found to be free from pests and diseases certificates of inspection are granted to the nurserymen. Very little stock is now grown in Montana. Most of the danger lies in nursery stock shipped into Montana and too careful watch cannot be kept on these shipments.

Enforcement of Quarantines.

The State of Montana at the present time is maintaining three quarantines which are printed elsewhere in this report. They are directed against the spread of white pine blister rust, wheat rust and the alfalfa weevil. All horticultural inspectors are charged with the enforcement of the quarantine provisions. This work naturally fits in with the fruit and nursery stock inspection and the inspection force is well organized to accomplish results.

Orchard Inspection.

Orchard inspection is maintained throughout the fruit-growing sections, the purposes of which are as follows:

It enables the inspection service to keep track of the pests and diseases already present, to define the boundaries and to suggest methods of control. To enforce and supervise the spraying of all orchards where dangerous insect pests or diseases are found.

Diseases.

The following report on diseases and pests mentions only those which are of greatest importance:

Apple Scab: This disease is prevalent throughout all the western portion of the state. It annually causes thousands of dollars' worth of damage in misshapen and unsalable fruit. The past few years being dry and unfavorable to the development of fungus diseases but little damage has occurred but will return with wet seasons. Scab can be controlled by thorough spraying with lime-sulphur.

Bacterial Blight: This disease has done much damage in past years but like the scab is more prevalent during wet seasons and for several seasons has caused little damage. The more susceptible varieties such as the Alexander and Transcendent crab have largely disappeared, and for that reason the blight may never return with the same violence as in the past. The only known remedy is by cutting out the diseased parts or removing entirely badly affected trees.

Insect Pests.

Blister Mite: Apple and pear trees are attacked by this insect and badly affected trees lose their leaves before summer is over. This insect is a microscopic mite which feeds within the leaf causing the characteristic browning of the leaves. The injury caused is worse during dry seasons than during rainy seasons.

Bud Moth: The damage by the bud moth is increasing each season in unsprayed orchards. It can be easily controlled by arsenical sprays.

Codling Moth: The codling moth is present in most of the cities and has been allowed to gain a foothold in nearly all of the orchard districts, except that of Flathead county. It can be controlled by spraying with arsenic of lead and in a number of instances has been completely eradicated. A campaign for eradication is planned for the coming spring.

Oyster Shell Scale: This is the worst scale insect in the state. It is not of much importance in well cared for orchards, but it is present in practically all old and neglected plantings. While it is almost everywhere present it does not spread easily or rapidly from old to well cared for orchards. It can be controlled by thorough and persistent spraying.

San Jose Scale: This is the most destructive of all scale insect pests but has not as yet been found in Montana orchards. The opinion is prevalent that it cannot exist in Montana climate but it is prev-

alent in states where the climate is more severe than ours and we should not rely upon climate, and inspectors are cautioned to prevent its being admitted on nursery stock or fruit.

Leaf-Roller: The leaf-roller, which was first brought to the notice of the fruit grower three years ago, has rapidly increased until the past season much damage was done and unless brought under control will practically destroy the fruit industry of the Bitter Root valley. This insect is more fully dealt with elsewhere in this report. It can be controlled and steps are being taken to do so.

Aphids: These sucking insects occur in practically all the orchards and are of many different species. The green aphids which feed on the leaves and growing twig tips are the most common, but in some places the woolly aphids, which feed both on the roots and upper parts of the tree, are becoming established. The green aphids can be controlled by spraying but satisfactory results in combating the woolly aphids are hard to secure. The total damage to the fruit crop is not alarming.

There are many other insect pests of minor importance not enumerated in this article but as they are doing little damage growers are not worried about them.

Advisory Work.

Our inspectors in the fruit growing districts are devoting much time to advisory work, as has been the custom in former years. They endeavor to visit each orchardist in their district and advise as to the proper methods in pruning, spraying, thinning, etc., and later give instructions, where needed, in picking, grading and packing the fruit. The work is resulting in much good and better methods are rapidly being developed by fruit growers from this service.

FINANCIAL STATEMENT

February 28, 1919

Receipts

Regular Appropriation	\$11,500.00
Salary State Horticulturist	2,766.68
Salary Secretary	1,000.00
Horticultural Spray Tax	538.06
Nursery Tags	5.70
Maintenance Account	1,510.48
Excess Inspection	803.81
Publishing Proceedings Horticultural Society.....	300.00
Fruit and Nursery Stock Inspection	6,153.79
Spray Machinery and Supplies.....	155.00
Nursery Licenses	550.00
	<hr/>
	\$25,283.52

Disbursements

Expenses Board Members at Meetings.....	\$ 399.83
Nursery Tags	5.70
Traveling Expenses	967.45
Orchard Inspection and Spraying	5,377.50
Office Expenses	1,860.47
Publishing Proceedings Horticultural Society.....	600.00
Salary State Horticulturist	2,500.00
Salary Secretary	1,000.00
Fruit and Nursery Stock Inspection	10,729.23
Special Services	273.15
Spray Machinery and Supplies	1,303.27
In State Treasury—General Fund.....	.24
In State Treasury—Salary State Horticulturist.....	266.68
	<hr/>
	\$25,283.52

Financial Statement, December 31, 1920

Receipts

General Appropriation	\$11,500.00
Salary State Horticulturist	2,500.00
Salary Secretary	1,500.00
Horticultural Spray Tax	1,472.15
Maintenance Account	5,369.37
Office Expenses	106.92
Fruit and Nursery Stock Inspection.....	8,609.82
Spray Machinery and Supplies.....	890.60
Nursery Licenses	500.00
	<hr/>
	\$32,448.86

Disbursements

Expenses Board Members at Meetings	\$ 221.08
Traveling Expenses	1,024.76
Maintenance Account	2,802.03
Orchard Inspection	5,174.45
Orchard Spraying	3,583.77
Office Expenses	526.22
Fruit and Nursery Stock Inspection.....	10,695.74
Salary State Horticulturist	2,083.33
Salary Secretary	1,250.00
Special Services	193.09
Spray Machinery and Supplies	3,595.42
In Missoula Trust & Savings Bank.....	612.37
In State Treasury—General Fund.....	19.93
In State Treasury—Salary State Horticulturist.....	416.67
In State Treasury—Salary Secretary.....	250.00
	—————
	\$32,448.86

July 1, 1918, to and including June 30, 1919

FRUIT INSPECTED

Variety	No. Boxes
Apples	442,231
Pears	40,239
Peaches	137,801
Plums-Prunes	51,099
Cherries	11,897
Apricots	3,106
Quinces	254
Oranges	85,368
Lemons	44,124
Grapes	162,164
Miscellaneous	270
	—————
Total.....	978,553
Number of car lots inspected.....	1,252
Number cars Montana apples inspected.....	262

FRUIT CONDEMNED

	Codling Moth	Scale	Totals
Apples	874		874
Pears	10		10
Grape Fruit		251	251
Oranges		109	109
	—————	—————	—————
Totals.....	884	360	1244

MONTANA STATE BOARD OF HORTICULTURE

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FRUIT INSPECTED
July 1, 1918, to and Including June 30, 1919.
TOTALS BY PRACTICES

ELEVENTH BIENNIAL REPORT

July 1, 1918, to and Including June 30, 1919

NURSERY STOCK INSPECTED

Variety	Approximate No. Plants
Apples	14,362
Pears	189
Peaches	55
Plums-Prunes	2,279
Cherries	2,057
Apricots	9
Quinces	6
Shade	55,779
Ornamentals	52,637
Grapes	676
Strawberries	130,535
Blackberries	2,076
Raspberries	10,203
Currants	3,484
Gooseberries	1,990
Grafts	64
Seedlings	12,283
Evergreens	2,764
Total	291,448
Number of car lots inspected	8

NURSERY STOCK CONDEMNED

	On Account of			Total
	Crown Gall	Quarantine No. 4	Quarantine No. 2	
Apples	1,001			1,001
Raspberries		675		675
Currants			48	48
Gooseberries			43	43
Total	1,001	675	91	1,767

NURSERY STOCK INSPECTED

July 1, 1918, to and Including June 30, 1919.

TOTALS BY DISTRICTS

DIS- TRICTS	Apples.....	Pears.....	Peaches.....	Prunes Plums.....	Cherries.	Apricots.	Quinces..	Grapes....	Straw- berries.	Black- berries.	Rasp- berries.	Currants	Goose- berries.	Grafts....	Seedling	Ever- greens..	Car Lot..	Total.....	Fees.....	
14,362	189	55	2,279	2,057	9	6	55,779	52,637	676	130,535	2,076	10,203	3,484	1,990	64	12,283	2,764	8	291,448	\$279,05

July 1, 1919, to and Including June 30, 1920.

FRUIT INSPECTED

Variety	No. Boxes
Apples	517,766
Pears	42,642
Peaches	219,902
Prunes-Plums	50,599
Cherries	3,400
Apricots	3,624
Quinces	210
Oranges	90,386
Lemons	48,489
Grapes	252,047
Miscellaneous	65
 Total	 1,229,130
No. of car lots inspected	1,525
No. cars Montana apples inspected	350

FRUIT CONDEMNED

	On Account of							Totals	
	Codling Moth	San Jose Scale	Scab	Oyster Shell Scale		Quar. No. 4	Decay		
				7	4				
Apples	5,780	43	757	7	4			6,591	
Pears		33						33	
Cherries						67	10	77	
Lemons			1					1	
 Totals.....	 5,813	 44	 757	 7	 71	 10		 6,702	

FRUIT INSPECTED
July 1, 1919, to and Including June 30, 1920.
TOTALS BY DISTRICTS

DISTRICT	Apples.....	Pears.....	Peaches.....	Cherries.....	Apricots.....	Quinces.....	Oranges.....	Lemons.....	Grapes.....	Miscel-laneous	Total.....	Car Lot..	Fees.....
	54,067	15,512	35,959	9,928	1,043	130	165	19,437	13,423	44,168	193,667	464,721	248 \$ 1,244.22
1st Dist.	99,073	16,267	107,645	22,080	1,641	2,522	165	42,145	22,517	150,601	65	464,721	551 2,880.87
2nd Dist.	96,183	8,450	45,098	17,487	1,104	716	45	19,718	9,442	42,167	238,545	297 1,493.38	
3rd Dist.	26,262	2,355	29,695	58	1,505			7,799	2,705	14,111	85,764	92 663.75	
4th Dist.	235,186	6,995						1,287	402	1,000	235,186	324 1,658.71	
5th Dist.											11,247	13 131.10	
6th Dist.													
7th Dist.													
Totals.....	517,766	42,642	219,902	50,599	3,400	3,624	210	90,386	48,489	252,047	65	1,229,130	1,525 \$ 8,072.03

ELEVENTH BIENNIAL REPORT

July 1, 1919, to and Including June 30, 1920

NURSERY STOCK INSPECTED

Variety	Approximate No. Plants
Apples	13,885
Pears	529
Peaches	297
Plums-Prunes	4,206
Cherries	3,273
Apricots	72
Quinces	16
Shade	23,855
Ornamentals	23,827
Seedlings	16,429
Grapes	882
Strawberries	156,331
Blackberries	4,969
Raspberries	15,864
Currants	3,426
Gooseberries	2,470
Evergreens	916
Miscellaneous	253
Total.....	271,500
Number of car lots inspected.....	7 2/3

NURSERY STOCK CONDEMNED

	Quar. No. 2
Currants	12
Gooseberries	12
	—
	24

NURSERY STOCK INSPECTED
July 1, 1919, to and Including June 30, 1920.

TOTALS BY DISTRICTS

DIS- TRICTS											Fees										
	TOTALS					ITEMS															
	Apples.....	Pears.....	Peaches..	Prunes Plums.....	Cherries.	Quinces..	Apricots.	Shade.....	Orna- mentals.	Grapes....	Straw- berries.	Black- berries.	Rasp- berries.	Currants	Goose- berries.	Ever- greens..	Seed- lings....	Miscel- laneous	Car Lots	Totals....	Fees
1st Dist.	2,359	39	114	1,829	265	2	7,333	9,177	275	27,709	467	1,341	356	333	267	13,254	4 ² ₃	65,120	\$1,512.5		
2nd Dist.	4,933	7	53	385	359	2	3,571	7,941	170	78,751	2,248	10,803	2,542	1,454	85	2,200	36	115,538	117.42		
3rd Dist.	1,97	10	2	173	88	11,132	3,761	62	7,844	18	485	174	449	59	170	217	1	24,841	202.15		
4th Dist.	3,513	202	112	1,410	689	34	12	1,565	284	33,627	2,020	2,415	146	104	505	800	2	48,378	78.50		
5th Dist.	1,223	28	2	15	689	37	6	47	4	3,100	20	44	20	44	44	5	5,215	23.00			
6th Dist.	1,456	239	14	354	1,152	1	2	873	1,316	87	1,350	196	651	208	130	5	8,034	41.00			
7th Dist.	204	4		40	31					20		125						4,374	5.50		
	13,885	529	297	4,206	3,273	72	16	23,855	23,827	882	156,331	4,969	15,864	3,426	2,470	916	16,429	253	7 ² ₃	271,500	\$618.82

ELEVENTH BIENNIAL REPORT

NUMBER OF BOXES OF FRUIT INSPECTED

	1911	1912	1913	1914	1915	1916	1917*	1918	1919	1920
Apples and Crabs.	263,760	461,854	436,033	338,321	501,770	346,211	173,501	469,230	442,231	517,766
Pears	23,083	25,729	16,851	22,040	29,274	22,644	301	40,799	40,239	42,642
Peaches	119,175	138,249	114,711	205,695	228,049	204,433	8,527	206,410	137,801	219,902
Plums and Prunes	32,747	39,273	26,450	29,554	44,477	59,485	510	70,917	51,099	50,599
Cherries	18,657	29,357	20,462	28,035	32,070	14,488	5,656	23,501	11,897	3,400
Apricots	4,789	6,775	4,167	4,892	4,625	5,404	1,262	6,033	3,106	3,624
Quinces	539	565	513	364	400	214	43	43	254	210
Oranges	99,592	93,943	65,980	114,371	161,739	103,007	119,354	96,953	85,368	90,386
Lemons	25,702	32,208	29,441	27,907	50,138	33,093	33,210	41,502	41,124	48,489
Grapes	184,871	192,331	76,228	164,715	151,548	155,207	1,056	189,438	162,164	252,047
Strawberries	44,932	56,316	60,639	91,680	78,463	129,246				
Blackberries	8,598	11,774	7,567	14,923	17,366	12,208				
Raspberries	18,577	17,436	25,978	42,835	45,897	40,080				
Dewberries	443	646	2,302	2,045	560	117				
Blueberries	104	201	733	635	212	791				
Currants	977	1,067	1,027	180	3,968	453				
Gooseberries	856	563	739	824	1,292	297				
Miscellaneous									2,934	7,478
									270	65
	847,402	1,108,287	889,821	1,089,016	1,351,848	1,127,378	346,311	1,152,304	978,553	1,229,130

*** Includes only 7 months.**

FRUIT CONDEMNED

	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920
Apples (old boxes)										
Apples (for scab)	746	312	1993	3008	950	2315	1945	10	757	
Apples (for coddling moth)	140	34	750	1688	1447	783	50	918	5780	
Apples (for scale)	196	238	20	111	640	388	2	1915	50	
Apples (for rot)								67	874	
Apples (for worms)										5780
Cherries (decay)										50
Pears (scab)	2									10
Pears (worms)										
Pears (scale)										
Pears (coddling moth)	146	151	10	318	420	47	32	549	10	
Pears (blight)	72	7	72	35	622	360	369	128	scale & worms pears	
Peaches (coddling moth)										
Peaches (twig borer)										
Peaches (worms)										
Plums (scale)										
Plums	57	10	7	46	763	35	9	668	63	
Apricots (for shot hole fungus)										
Apricots (for scale)										
Apricots (worms)										
Oranges (scale)	244	2	12					792	396	
Oranges (worms and scale)									300	
Grape Fruit								1	13	
Lemons (purple scale)	14	40	18	5						
Lemons (San Jose scale)										
Raspberries (powdery mildew)										
Raspberries (use of old boxes)										
Gooseberries (for powdery mildew)	30	7						1		
Quinces (coddling moth)								6	46	
Quinces (worms)									77	
Miscellaneous (violation quarantine law)								32	1	71
	1849	1155	3172	7520	4323	5895	2010	2542	1244	6701

ELEVENTH BIENNIAL REPORT

NURSERY STOCK INSPECTED—APPROXIMATE NO. OF PLANTS

	1911	1912	1913	1914	1915	1916	1917*	1918	1919	1920
Evergreens					2,000					64
Roots	2,100	136,763				133,606	19,702	416,593	12,283	
Grafts	491,711	209,413	123,850	219,889	96,699	42,663	23,098	21,348	14,362	13,885
Seedlings	189,425	9,733	5,263	7,993	3,936	1,140	457	329	189	529
Apples and Crab Apples	7,528	1,736	1,746	1,880	271	177	132	27	79	297
Pears										4,206
Peaches										
Plums and Prunes	8,489	79,521	14,395	271	9,128	13,897	4,037	6,679	2,279	
Cherries	39,518	80,671	36,350	95,908	36,090	9,275	6,167	5,397	2,057	3,273
Apricots	824	459	440	16,623	50	85	59	6	9	72
Quinces	61	2	36	1,045	1	22				16
Grapes	673	3,464	7,323	16,121	2,594	3,390	1,006	1,451	676	882
Strawberries	42,793	99,161	184,320	316,813	170,870	203,660	147,369	125,130	130,535	156,331
Blackberries & Dewberries	7,038	18,929	9,216	35,513	3,892	5,011	6,969	3,790	2,076	4,969
Raspberries	18,159	46,523	49,108	121,138	21,224	26,485	8,015	19,936	10,203	15,864
Blueberries										
Currants	4,816	5,604	19,928	19,479	7,957	13,039	4,788	3,446	3,484	3,426
Gooseberries	5,221	12,417	17,881	29,180	8,447	11,424	3,208	3,263	1,990	2,470
Shade	91,205	86,929			82,049	537,379	165,550	223,766	55,779	23,855
Ornamentals	41,803	50,725			23,882	116,512	29,349	51,785	52,637	23,827
Miscellaneous	761				784,715	541		1,046		253
Asparagus					1,060					
	953,861	842,110	1,085	105	1,665,072	470,282	1,118,584	1,420,179	884,114	291,448
										271,504

* Includes only 7 months.

NURSERY STOCK CONDEMNED

	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920
Apple Trees (root gall, crown gall, hairy root)	769	287								
Apple Trees (root gall, woolly aphid)										
Apple Trees (crown gall)										
Apple Trees (blight)										
Pear Trees (root gall, crown gall, hairy root)	20		9							
Pear Trees (root gall)										
Cherry Trees (root gall, crown gall, hairy root)	12		3							
Cherry Trees (for root gall)										
Cherry Trees (for root gall, woolly aphid)										
Cherry Trees (for crown gall)										
Peach Trees (root gall, crown gall, hairy root)	10									
Currants (W. P. B. R. quarantine)										
Gooseberries (W. P. B. R. quarantine)										
Plum Trees (root gall, crown gall, hairy root)	10									
Raspberries (root gall)										
Raspberries (Quarantine No. 4)										
Strawberry Plants (woolly aphid)										
Ornamentals (root gall)										
Shade Trees (crown gall)										
Shade Trees (woolly aphid, root gall)										
Shade Trees (root gall)										
	821	299	210	1658						
					57	128	257	1767	24	

MONTANA LICENSED NURSERIES

Licenses Expiring June 30, 1919.

No.	Name	Address
508	Albany Nurseries	Albany, Oregon
509	Hopper's Greenhouse & Nursery.....	Billings, Montana
510	Salem Nursery Co.	Salem, Oregon
511	Jewell Nursery Co.	Lake City, Minnesota
512	Oscar H. Will & Co.	Bismarck, No. Dak.
513	E. M. Sherman	Charles City, Iowa
514	Northwest Nursery Co.	Valley City, No. Dak.
515	Clinton Falls Nursery Co.	Owatonna, Minnesota
516	Henry A. Dreer, Inc.	Philadelphia, Pa.
517	Stark Bro.'s Nursery & Orchard Co.	Louisiana, Missouri
518	Rose Hill Nursery	Minneapolis, Minn.
519	Sonderegger Nursery & Seed House.....	Beatrice, Nebraska
520	Hankinson Nursery Co.	Hankinson, No. Dak.
521	Deerfield Nursery Co.	Medford, Minnesota
522	State Nursery & Seed Co.	Helena, Montana
523	Gurney Seed & Nursery Co.	Yankton, So. Dak.
524	Farmers' Seed & Nursery Co.	Fairibault, Minnesota
525	R. M. Kellogg Co.	Three Rivers, Mich.
526	Oregon Nursery Co.	Oreenco, Oregon
527	Missoula Nursery Co.	Butte, Montana
528	Howard Lake & Victor Nurseries.....	Howard Lake, Minn.
529	Missoula Greenhouse & Nursery Co.	Missoula, Montana
530	Home Nursery, Fred Inabnit, Prop.	Billings, Montana
531	Lake Avoca Nursery	Butte, Montana
532	Northern Nursery Co.	Denver, Colorado
533	Englewood Nursery Co.	Butte, Montana
534	Henry Struck	Columbus, Montana
535	Washington Nursery Co.	Toppenish, Wash.
536	Toppenish Nursery Co.	Toppenish, Wash.
537	Yakima Valley Nursery Co.	Toppenish, Wash.

Licenses Expire June 30, 1920.

538	Albany Nurseries	Albany, Oregon
539	Hopper's Greenhouse & Nursery.....	Billings, Montana
540	Northwest Nursery Co., 556—1921.....	Valley City, No. Dak.
541	State Nursery & Seed Co.	Helena, Montana
542	Jewell Nursery Co.	Lake City, Minnesota
543	Farmers' Seed & Nursery Co.	Faribault, Minnesota
544	Stark Bro.'s Nursery & Orchard Co.	Louisiana, Missouri
545	Gurney Seed & Nursery Co.	Yankton, So. Dak.
546	Oscar H. Will Co.	Bismarck, No. Dak.
547	Salem Nursery Co.	Salem, Oregon

No.	Name	Address
548	Henry A. Dreer, Inc.	Philadelphia, Pa.
549	Howard Lake & Victor Nurseries	Howard Lake, Minnesota
550	Oregon Nursery Co.	Orenco, Oregon
551	Yakima Valley Nursery Co.	Toppenish, Wash.
552	Billings Plant & Culture Co.	Billings, Montana
553	R. M. Kellogg Co.	Three Rivers, Michigan
554	Sonderegger Nursery & Seed House	Beatrice, Nebraska
555	Englewood Nursery Co.	Butte, Montana
557	Missoula Nursery Co.	Butte, Montana
558	Missoula Greenhouse & Nursery Co.	Missoula, Montana
559	Toppenish Nursery Co.	Toppenish, Washington
560	Washington Nursery Co.	Toppenish, Washington
561	Home Nursery Company	Billings, Montana

Licenses Expire June 30, 1921

556	Northwest Nursery Co.	Valley City, No. Dak.
562	Albany Nurseries	Albany, Oregon
563	Salem Nursery Co.	Salem, Oregon
564	Oregon Nursery Co.	Orenco, Oregon
565	State Nursery & Seed Co.	Helena, Montana
566	Oscar H. Will Co.	Bismarck, No. Dak.
567	Jewell Nursery Co.	Lake City, Minnesota
568	Henry A. Dreer	Philadelphia, Pa.
569	Hopper's Greenhouse & Nursery	Billings, Montana
570	Stark Bro.'s Nurseries & Orchard Co.	Louisiana, Mo.
571	Gurney Seed & Nursery Co.	Yankton, So. Dak.
572	Missoula Nursery Co.	Butte, Montana
573	Sonderegger Nursery & Seed House	Beatrice, Neb.

MONTANA HORTICULTURAL INSPECTORS

DISTRICT NO. 1

CITY	COUNTY	INSPECTOR
Billings	Yellowstone	Algeo, Ned
Columbus	Stillwater	Kucera, James
Glendive	Dawson	Auble, C. P.
Joliet	Carbon	*Crismas, W. J.
Livingston	Park	Garvan, Jno. A.
Miles City	Custer	Ames, Truman
Park City	Stillwater	Bessette, J. E.
Red Lodge	Carbon	Chapman, L. P.
Wibaux	Wibaux	

DISTRICT NO. 2

Bozeman	Gallatin	Parker, J. R.
Butte, 1039 Iowa Ave.	Silver Bow	Fossum, J. A.
Dillon	Beaverhead	Newnes, J. T.
Harlowton	Wheatland	Ruerup, J. H.
Helena	Lewis and Clark	Malcolm, S. H.

DISTRICT NO. 3

Glasgow	Valley	Whitbread, A. H.
Great Falls	Cascade	Decker, Walton
Havre	Hill	Trump, E. F.
Lewistown	Fergus	Dodge, C. H.
Mondak	Sheridan	Newcomb, A. S.

DISTRICT NO. 4

Anaconda	Deer Lodge	Kelly, M. J.
Missoula	Missoula	Fox, Edwin

DISTRICT NO. 5

Hamilton	Ravalli	Shovell, W. L.
Stevensville	Ravalli	Jones, Arthur E.

DISTRICT NO. 6

Big Fork	Flathead	*Platt, A. V.
Kalispell	Flathead	Roush, Roy
Polson	Flathead	Behrns, Mrs. A. C.

DISTRICT NO. 7

Plains	Sanders	Putnam, W. F.
Plains	Sanders	*Willis, C. C.

*Board Members.

FRUIT TREE LEAF ROLLER

Copied from Manual of Fruit Insects by Slingerland and Crosby.

Recorded as common throughout practically the whole of the United States, this insect is one of the most destructive of the leaf-rollers infesting fruit trees. It has been especially injurious in the orchards of New York, Missouri and Colorado, attacking apple, pear, cherry, plum, apricot, quince, rose, currant, raspberry and gooseberry, besides about a dozen different kinds of forest trees; curiously enough peaches seem to be exempt from attack. It is thus a very general feeder and it sometimes strips fruit trees and ruins many of the young fruits.

The eggs are laid in June on the bark of the twigs in small, flat, light brown, or grayish patches, each patch containing about 150 eggs and covered with an impervious gummy substance. The winter is passed in the egg stage. The caterpillars hatch about May 1, and enter the opening buds, where they roll and fasten the leaves loosely together with silken threads into a nest within which they feed. After the fruits set, they are often included in the nests and ruined by the caterpillars eating large irregular holes in them. The caterpillars get their growth in 2 or 3 weeks, and are then about $\frac{3}{4}$ of an inch long, light green in color with the head, legs and thoracic shield varying from brown to black. About ten days are spent as a brown pupa in a delicate silken web or cocoon in the nest early in June. The moths emerge, and soon lay the peculiar patches of eggs on the bark, thus completing the life-cycle of the single annual generation of this leaf-roller. The pretty little moths, measuring about $\frac{3}{4}$ of an inch across the expanded wings, vary considerably in coloring and markings. The front wings are rust-brown in color, marked with bands and spots of very pale yellow. A number of hymenopterous parasites attack this leaf-roller. Toads often eat many of the caterpillars that drop from the trees, and red-winged blackbirds are efficient enemies in Colorado.

MEANS OF CONTROL

The leaf-roller has been found a difficult insect to control by ordinary spraying with arsenical poisons. Recent work in Colorado has shown, however, that over 95 per cent of the eggs can be destroyed by one thorough application of a miscible oil, one part in 19 parts of water, made early in the spring while the trees are dormant.

THE CONTROL OF THE FRUIT TREE LEAF ROLLER

By Leroy Childs, Entomologist and Pathologist, Hood River Branch Experiment Station.

(This article is cut from a paper on "The Life History and Control of the Fruit Tree Roller" presented by Mr. Childs at the Sixteenth Annual Meeting of the Washington State Horticultural Association, held at Spokane on December 13 to 17, 1920. Only the portions relating to control are herein reprinted.)

You are probably more interested in the control of the leaf-roller than in the discussion of its life history. The control of the pest is not easily obtained. The habit of the insect, tying the leaves together and spinning about them a protective web makes it difficult to get at the worms with a contact spray or apply a poison to the surfaces upon which they are largely feeding. Early spring spraying with miscible oils is also accompanied with many difficulties, chief of which is unfavorable weather condition occurring at the time applications should be made.

For the most part, endeavors towards effecting control have been along three lines: poisons and contact sprays, such as arsenate of lead and black leaf forty applied to destroy the young worms after they have hatched, and oil sprays directed towards the destruction of the eggs and applied to the trees in the spring before hatching takes place.

Extensive experimental work along all of these lines has been carried out in New York, Colorado and in Oregon, and in the final analysis of this work results have been much the same, namely, that after the insects hatch, control from the standpoint of reducing the percentage of damaged fruits has been unsatisfactory.

The causes for the failure of poison and contact sprays in destroying this worm are probably two-fold. First, that the insect is highly resistant to poison, and second, due to its habit of folding and tying the leaves in such a way as to prevent the thorough coating of a large proportion of the foliage upon which the insects are feeding. I believe that it can be safely stated that no present known insecticide can be applied after the worms have hatched and accomplish a benefit which would warrant its use. Some protection from complete defoliation is, however, accomplished, and applications of arsenate of lead would be of some value to reduce this.

Oil emulsions of various kinds, including kerosene, distilate, car-

bolic acid, crude and more refined heavy oils have been used and results noted in various sections of the country, as agent employed for the destruction of the eggs.

In summarizing this work it may be stated that applications possessing greatest merit have invariably been those emulsions made from rather heavy refined types of oil. Light oil emulsions, such as kerosene or distillate, are much too volatile to effect killing. The oil either evaporates too quickly or fails to penetrate the egg masses sufficiently to prevent hatching. In some of the work carried on at Hood River we found more eggs hatching on trees sprayed with an 18% kerosene emulsion than on the unsprayed check trees, indicating, of course, that no benefits were derived from the application.

Unfortunately, under certain conditions at least, the mere fact that a thorough application of oil has been given, does not always insure successful control of the leaf-roller. This has been discouraging to some growers who have had unfortunate results. The causes that bring about irregular results are not altogether known at the present time. However, the more important factors involved are weather conditions, chiefly that of temperatures and rainfall at the time of or immediately following applications of the spray. In 1915 at the time our first work with miscible oil was undertaken at Hood River, weather conditions for obtaining good results were ideal. So good were these results that we felt confident that control was only a matter of thoroughness of application. Since that time numerous variations in results have occurred both in the experimental work and in orchards that have been under the observation of the writer for the past 5 years.

Tests carried on during this time have shown conclusively that rain immediately following applications invariably greatly reduces the percentages of eggs that would ordinarily be killed by sprays favorably applied. This is probably due to the fact that a portion of the oil is removed and insufficient amounts of the material remain to accomplish desired results. In connection with these observations, it appears to be a fact that greater strengths of the emulsion—say 8 to 10 gallons of the oil to 100 gallons of water—give better results than does a 6 per cent emulsion applied under the same conditions. Rains often following oil applications even as late as two or three days have been observed to materially effect control, while on the other hand complete results have been obtained with

rain falling as soon as twenty-four hours. We do not know just why this condition should occur but it seems to indicate that temperature is involved and perhaps the stage in the development of the eggs. It seems quite logical to believe that eggs could be more easily destroyed in some stages of their incubation than in others. These are problems that we are working on at the present time.

The particular brands or makes of oil, which may be used to best advantage in leaf-roller control have been largely discussed—chiefly by the various manufacturers. Each and all believe that their particular brand is the ideal spray and they are probably entirely honest in this belief. We find that the eastern manufacturer boosts his product because it is made from a paraffin base oil; the westerner talks his up on account of the fact that it is made from an asphaltum base. In the final analysis probably neither can help himself, as they undoubtedly have to use the oil available in the particular sections from which to make their spray. As far as our experimental work goes—and it seems to have been found in other sections—either type of oil will give the same results if applied at the same strengths under similar conditions. Growers should remember, however, that the oil spray is a specific, benefits from which application are quite definitely confined to certain orchard pests and can not be used as a cure-all as often represented in advertisements.

As has been stated before, light oils have not proved effective. The requirements of an oil which will give maximum results under all conditions are not known at the present time. Most of the work that has been done with lubricating oil has been with oils running in specific gravity from 28 to 22 degrees Beaume. The most consistent results obtained in the control of the leaf-roller seem to point to the fact that a 22 degree oil can be used more effectively than a 28 degree oil.

Based upon our earlier results with miscible oils, a recommendation of 6 gallons to 100 gallons of water was made. However, since the other factors which have been discussed appeared—and materially effecting results—our recommendations have been increased to an 8 to 100 mixture. The results obtained during the past two years by Hood River growers point to the fact that much more consistent results are attained with this strength than was true of the weaker dilution.

Regardless of the factors which have just been discussed adding

to the difficulties of control the most important circumstance that has come to our attention with reference to incomplete control has been due to poor spraying or the failure on the part of the orchardists to use sufficient spray on each tree. It has been my observation that poor spraying is responsible for at least 75% of the failures reported by growers. Contrary to the common belief it is very difficult to cover every part of the tree with the spray. Spray must be wasted to accomplish this and it is right here where many growers fall down.

In procuring control of the leaf-roller the average orchardist is up against a more serious problem than he realizes. As has been stated before, it is not an uncommon occurrence to find a tree possessing from 100 to 200 egg masses or between 5000 to 10,000 eggs. Under ordinary conditions 95 to 98 per cent of these eggs hatch into very hearty eating young worms. Often trees in badly infested centers have present many more eggs than this. These eggs are scattered over the entire tree with the exception of the last season's growth and in order to cover these with spray every portion of the tree must not only be sprayed but drenched with oil. Our study of the problem shows that growers who obtain effective control year after year use the spray in the following proportions per tree: At 11 years, 4.1 gallons of spray; at 12 years, 4.5 gallons; at 13 years, 5.6 gallons, or an increase of about a gallon a tree per season. This observation has not been noted on trees older than 17 years. Trees of this age require 8 gallons of spray. If much less material than this is used good results can not be expected.

From personal observation I know that the first experiences of most orchardists in the use of oil for the control of this insect has usually been accompanied with but partial or poor results—and this to a very large degree has been the result of poor spraying. Most of our growers have learned the need of extremely thorough work, by experience, and not from the advice given them. If you can reap the benefit of their experience and the advice that has been given it will save you much money, for the oil spray is expensive, and especially so when control is not obtained.

My advice to you is thoroughness of application above all things else. You will get better results by spraying half of your orchard right than all of your orchard poorly. Many miscible oils now on the market are good products and can be emulsified with little trouble. The best procedure in the preparation of the spray is as follows:

Thoroughly rock the barrel before drawing off the oil. The ingredients are liable to separate if allowed to stand undisturbed. This will insure uniformity. Draw off the required amount of oil for the tank and mix with equal parts of water, stir until a thick, white emulsion is produced. If this does not take place immediately, add a little more water. Place this in the tank with the agitator running and fill the tank with water.

The best time to make the applications can not be definitely stated. Get the spray on during clear warm weather if possible. The oil can be used safely up to the time the buds begin to burst. At this period the spray is very beneficial in destroying brown and green aphids and I have found it much superior to tobacco for this purpose. Remember above all things that thoroughness of application is the most important factor involved in the control of this pest. If you religiously follow this practice excellent control can be expected.

COLORADO LEAF-ROLLER IN THE BITTER ROOT VALLEY

(Cut from a paper presented by R. K. Thompson of Darby, Montana, at the Sixteenth Annual meeting of the Washington State Horticultural Association held at Spokane, Washington, on December 13 to 17, 1920. The two paragraphs giving the life history of the leaf-roller have been inserted.)

In the spring of the 1919 I noticed for the first time the effects of the Colorado leaf-roller in my orchard. On investigating different parts of the orchard I found an egg mass on a tree here and there and occasionally three or four. At the time of discovery it was too late to control the insect even had I known what to do. During the spring and early summer the damage done by the insect over the orchard as a whole was not severe. The leaves were curled on a few trees here and there and some apples were damaged. However, one tract of about forty acres was more severely damaged than the rest of the orchard. Here the foliage of nearly all the trees showed the work of the leaf-roller. When the moths appeared they were very numerous in this block and spread over an area of about four hundred acres plastering the trees with egg masses. Many trees showed two or three hundred egg clusters.

Distribution

I endeavored to learn all I could about the insect and found that the Colorado leaf-roller is an old and widespread pest. It was described as early as 1863 and occurs in New York, New Jersey, Georgia, Missouri, Texas, New Mexico, California, and Colorado, and has more recently spread to Oregon, Washington, Idaho, and Montana. The outbreaks in the East and Southwest have not been serious, but in the West the outbreaks have been very serious, especially in Colorado, where it appeared in 1891. In Fremont County, according to Professor List of that state, it has threatened to destroy the fruit industry and the growers are still fighting it. The sudden and rapid growth of the leaf-roller in the Bitter Root Valley in 1919 was probably due to the dry, hot weather of that spring and summer and of the two preceding years. Under similar weather conditions we might expect further outbreaks.

Life History

The leaf-roller begins its life cycle in the egg stage during the summer. The egg masses are glued to the twigs, limbs and trunks

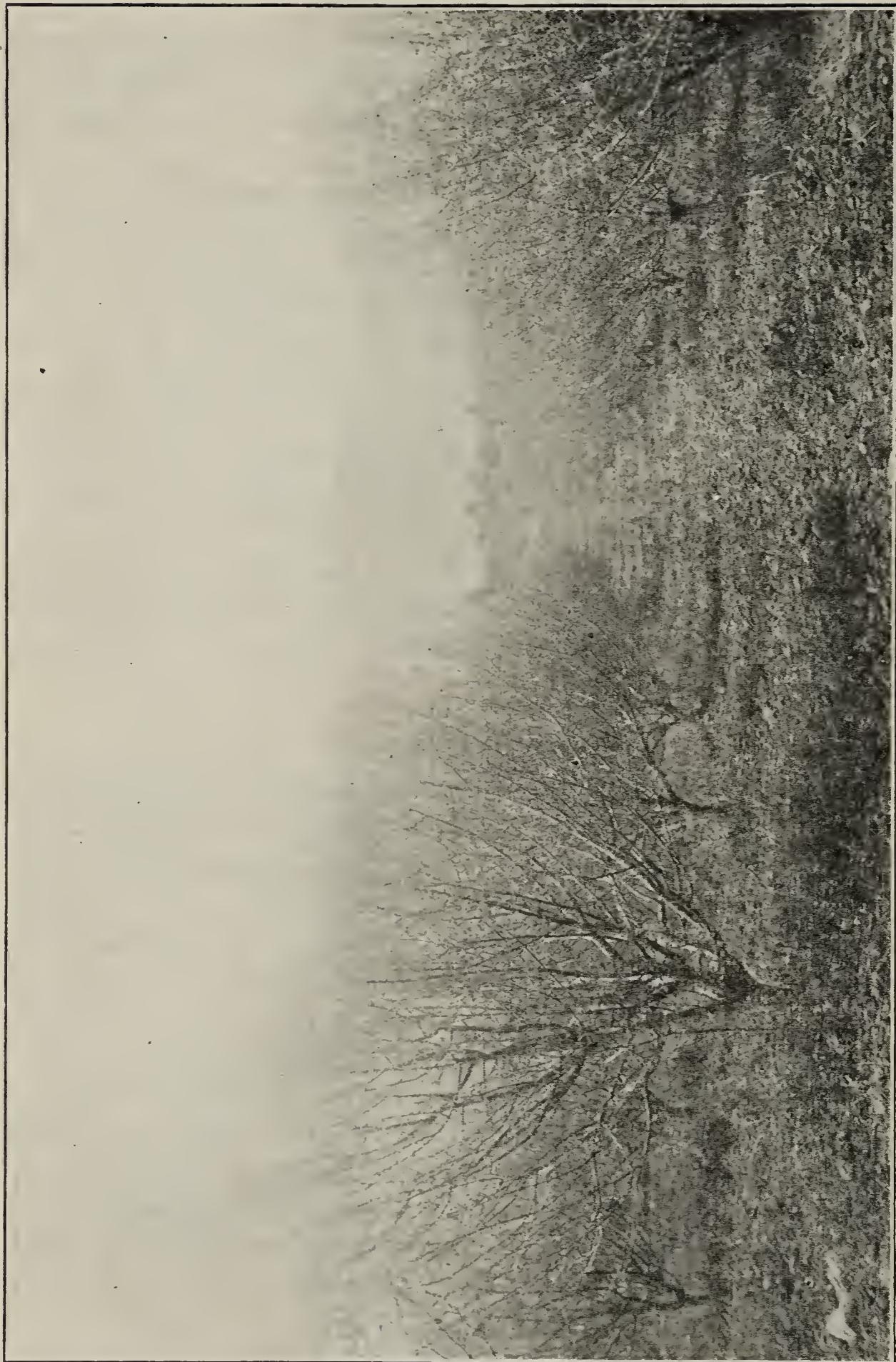


Photo made in July of a Bitter Root orchard completely defoliated by the work of the leaf-roller larva.



A close up view of a single tree showing the white egg masses and the webs made by the larvae in their movement from one part of the tree to another.
Photo taken in July.

of the trees and pass the winter in this condition. The following spring when the trees are well in leaf the eggs begin to hatch. At blossoming time the worms move into the blossoms, causing the flowers to drop so that badly infested trees set no fruit even though they blossom heavily.

Until after midsummer the worms continue to feed on the leaves rolling them up into nests and where numerous, completely defoliating the tree. Toward midsummer the worms change to pupae within the leaf nests and from these emerge as moths after midsummer. The moths then lay their eggs in patches on the trees to produce a new generation of worms the following spring.

Severity of Attack

The severity of the attack on about one hundred acres of our orchard, I believe, has not been equaled, even in Colorado. In this block the larvae were abundant and not only destroyed all the fruit but absolutely defoliated the trees so that all that remained was naked branches and the brown remnants of leaves. After the supply of green leaves was gone the worms swung loose from the tree and let themselves to the ground by means of their web. There they attacked everything green, including the weeds in the cultivated fields or alfalfa where it was growing as a cover crop.

Remedies

In the summer of 1919 when I realized the seriousness of the pest I turned to the remedies. I found that the most effective spray used against it in Colorado was Scalecide, and this had also been used with good results in New York. In Hood River, Mr. Childs was using a western oil successfully, namely, Durmoil, manufactured in Hood River. Owing to the difficulty of securing the eastern oil in any quantity last spring, I decided on a western oil and finally bought Sherwin-Williams Spray Mulsion.

Spraying

Our spring was very backward and we did not start spraying until the 9th of April, and the records show that during April we sprayed the following full days: 9th, 13th, 18th, 19th, 22nd, 23rd, 24th, 26th, 29th. On several other days we made a start but found conditions were not satisfactory and stopped. The days between the dates mentioned were too wet from rain or sleet. During this spray-

ing period, especially at the start, the mornings were cold and sometimes ice had been formed during the night. We used the Spra Mulsion, with the exception of the first day, on the basis of seven gallons of oil to one hundred of water. We sprayed with Hardie and Bean sprayers at a pressure of 300 pounds, although at times on some of the older sprayers the pressure was not maintained. We used guns and the spraying was thoroughly done and the trees soaked. About two hundred and fifty acres were sprayed during April from the first car of Spra Mulsion. The result was negligible; few, if any, egg masses were killed. This section was the most seriously affected in 1919 and I sprayed it first to be sure it would be covered.

There was a delay of a few days in shipment, and the second car of Spra Mulsion arrived the 4th of May, and we started again and continued until the 10th without interruption, the weather remaining warm and clear and ideal for spraying. One hundred and fifty acres were covered during this time. About ninety before the leaf buds had opened and sixty while they were opening and the young leaves appearing. The eggs began hatching shortly after the 10th, but we stopped spraying because of the spray injury to the young foliage, as the leaves suffered considerable damage, although afterward new leaves pushed out and the trees recovered.

At this period we used the Spra Mulsion on the basis of eight gallons to one hundred gallons of water, and secured much better results. On the ninety acres we obtained about 50% kill, although this was by no means a control, and both fruit and foliage suffered severe damage. The sixty acres gave the best results, and we showed from 50% to 75% kill. This saved our fruit and prevented serious leaf damage from the larva.

Conclusions

From the foregoing results it would appear that weather conditions and the time of spraying relative to the time of hatching are important factors as well as the strength of the mixture. I am of the opinion that I should have used a very strong mixture in the early spraying, possibly ten to twelve gallons of the Spra Mulsion to each one hundred gallons of water, and even then it might have been necessary to have sprayed a second time when the rain occurred during a period of a couple of days following the application. The results obtained by my neighbors using the oils were no better than my own.

Painting

I noticed that on comparatively young trees most of the egg masses were deposited on the trunk and main branches. I conceived the idea of painting these egg masses with full strength oil and secured control over sixteen hundred acres in that manner.

Pruning

Another plan which we tried successfully was a severe pruning and heading back of the tree to increase its vigor and simulate its leaf growth, and thus enable it to withstand the attack of the worms.

A block of one hundred acres of orchard most severely damaged by the worms in 1919 was so pruned. This orchard was part of the two hundred and fifty acres sprayed early and without results, and consequently had an abundance of worms, but the trees were able to put out leaves faster than the worms could eat them, and as a result were not defoliated and came through in fair shape. Trees not heavily pruned were defoliated, and although they put forth a second crop of leaves they were so weakened we cannot expect any fruit for at least another year and perhaps longer, and I doubt if they would recover at all from a similar attack this year.

Arsenate of Lead

After failing with the oil I tried arsenate of lead. Four pounds of the dry powder to one hundred gallons of water at the time the flower buds were beginning to separate and up to the pink stage. I found many dead larva in the bud clusters and believe the spray helped control the larva in their early stage of work on the flower buds as other parts of the orchard not sprayed showed the flower buds woven together and eaten, which was not the case where I had sprayed. I also put on a pink scab spray of lime-sulphur, and used arsenate of lead with it and obtained similar results.

From my experience I doubt that it would pay to put on an arsenic spray for leaf-roller alone; although I think it is of advantage in combination with lime-sulphur for a pink scab spray.

Paris Green

Growers near Spokane tried last summer to control the leaf-roller with paris green. Even when used at such strength that the foliage was severely burned and the nozzle-men could not stand the burning of the spray on their hands and faces the worms were not all killed and it had to be given up.

What Bitter Root Is Doing and What We Have Learned

Checking up the results of our first spraying season against the leaf-roller we found they were far from satisfactory, and that we must undertake a study of the oil sprays offered and the time and strength of application before we can hope to improve. Professor J. R. Parker of the Agricultural Experiment Station, Bozeman, came to our valley this summer to undertake experiments and aid us in the fight.

He made a collection of the leading oil sprays and has sprayed a tract of the orchard with each brand of sprays. This spraying was done a short time ago and the results will be checked by taking branches with the egg masses upon them and starting them to grow in the greenhouse. Under these conditions the eggs not destroyed by the spray will hatch.

OILS.**Sherwin-Williams**

This oil contains 27% water, 2% of Phenols, 7% soap and 62% of mineral oil and dead coal tars. The mineral oil is composed of 75% of kerosene or of the kerosene type of oil. Mr. Parker believes the oil contains too much water and the oil is not heavy enough. Mr. Host, of the Sherwin-Williams Company, gives the following analysis of their oil:

27 inert matter water
Phenols 6%
Minerol oil 58%
Dry soap 9%
No coal tar

and had this to say after visiting the orchards this summer in the Bitter Root and in Washington:

Sherwin-Williams Spra Mulsion

"I find that miscible oils of the same type as Spra Mulsion are the most effective in controlling the leaf-roller. They penetrate the egg masses better than any other sprays and prevent the hatching. The carbolic acid contained in some of the sprays is very active and destructive to the eggs. It is quite evident that these oils should be used at a greater strength than generally recommended, and we are changing our recommendations for Spra Mulsion, and now advise its

use at the rate of 4 or 5 gallons to the 50 gallons of water. The spray should be applied prior to, but as near the hatching time of the eggs as possible. Favorable weather conditions at the time of application and several days following are essential to good results, and under no circumstances should spray be applied during cold, rainy, sleety weather. It requires several days for the oil to penetrate the egg masses and if rain falls before this is accomplished another spraying should be made.

Durmoil of Hood River

Durmoil, the oil manufactured by Mr. Olmstead of Hood River, contains 8% water, 3.6% of dry soap, 4% of phenols and 82% of mineral oil of a lubricating type.

Mr. Olmstead believes the phenols are a very active agent in the destruction of the egg. His oil has been used very successfully in Hood River and other parts of Oregon for the control of the leaf-roller. He advocates its use on the basis of eight gallons to one hundred gallons of water.

California Spray Chemical Company

Mr. R. Vickery of the California Spray Chemical Co. has this to say of the two oils manufactured by their concern for the control of the leaf-roller:

"In order to kill insect eggs it is necessary to have light fractions to penetrate the eggs, and heavy fractions to keep the light fractions of the petroleum from evaporating too rapidly. This crude oil emulsion is therefore made of a 23 degree Beaume Natural Crude Oil, fresh from the wells and contains the desired fractions. For the leaf-roller we use the emulsion at the rate of one gallon of emulsion to four or five of water.

"Years ago we came to the conclusion that a better distillate oil spray could be made than the miscible oil. The miscible oil was too expensive and separated into oil and water in the presence of the calcium or the Magnesium Salts contained in hard water. For this reason we made our distillate emulsion. We intend this winter to put this out in paste form, so as to increase the oil contents to 90% and reduce the freight. This is more distillate oil than is contained in any miscible oil. Our sample contains 66% distillate and should be diluted at the rate of one gallon of emulsion to six gallons of water."

Dormant Soluble Oil, General Chemical Company

Mr. Foster of the General Chemical Company writes the following of their Universal Dormant Soluble Oil:

"It contains over 80% of mineral oil known as the lubricating distillate type which is much heavier than kerosene." His agent at Missoula adds 2% Phenols and some dry soap. Their comments on the Fruit Tree Leaf-Roller are as follows:

"The pest can be and is most successfully controlled by the use of an oil spray during the *winter season* when the tree is entirely dormant.

"It should be applied during clear weather, when the trees are dry and when the weather is reasonably warm. Do not spray the trees while the temperature is near or below the freezing point. If any considerable amount of rain occurs within five or six days after the trees are sprayed the application should be repeated.

"It is most desirable to use the Dormant Soluble Oil at the rate of 12 gallons for each 200 gallon tank of spray."

Sealecide

Mr. Pratt, a manufacturer of Sealecide, the eastern oil, gives the analysis of Sealecide as follows:

Water	7%
Phenols	0
Dry Soap	0
Mineral oil	70%
Vegetive oil	20%
Alkali	1%
Naphaline	2%

"We use the Sulphonated Vegetable Oil as an emulsifier; in other words, corn or cotton seed oil with sulphuric acid and neutralized makes a fine soluble oil.

"We use a special distillate carrying as much of the native sulphur as possible and also prefer an *asphaltum* base oil because there is little or no sulphur in the parafine oil. (We have always been led to believe the superiority of an eastern oil over a western oil was the parafine base of the former.) I do not believe that the difference in affect is due to the mineral oil, but to the vegetable oil, 20% of which is compound. We advise the use of the material in

the spring of the year, just as the insects are hatching, or rather just before they hatch." Mr. Pratt states that Scalecide acts within an hour, and if Scalecide is applied the egg masses are destroyed in spite of a rain, unless it falls within an hour of the application.

Comparison Material

From a comparison of the material of the oils used in the different brands we find that Hood River, General Chemical, Scalecide and one oil of the California Chemical Company, are of the distillate lubricating type. Sherwin-Williams uses the kerosene type, while one oil of the California Chemical contains both.

We find that three western brands contain phenols and soap. Scalecide does not.

Amounts Used in Mixtures

As to the mixtures. General Chemical and Scalecide advocate six gallons to the one hundred of water. Hood River eight gallons, Sherwin-Williams, eight to ten, and California Chemical, fourteen to twenty.

Time of Application

Sherwin-Williams and Scalecide advise spraying as late in spring as possible. General Chemical advise winter spraying when weather is not freezing. Sherwin-Williams and General Chemical advise spraying in clear weather and to put on a second spray in case of rain following the spray within five or six days. Scalecide on the other hand, acts at once.

From the summaries it appears that the grower has several factors to take into consideration in making his selection of an oil. I have not mentioned price as *that* is subject to changes in various localities. As I stated before, we are waiting to make a selection after Professor Parker has advised us of his results.

CODLING MOTH CONTROL IN 1920

The present State Horticulturist took office February 1, 1920. At that time, from the best information available, the codling moth existed in the City of Missoula, where it had been present for many years and had been slowly spreading in every direction until checked by natural barriers. Control measures had been adopted by the State Board of Horticulture in former years, but from lack of sufficient equipment and co-operation of the citizens it was decided to forego any further attempt in Missoula the present season and to confine our labors to the commercial orchards. A spraying campaign was organized in the two principal apple growing districts adjoining the city, namely, the Rattlesnake and Orchard Homes. An inspector was placed in these two districts to direct and supervise the work, with the result that wormy apples in the sprayed orchards were reduced to the minimum. In some of the orchards sprayed no wormy apples were found. As these districts are composed of small tracts, and no one individual possessing sufficient acreage to justify the expense of owning a high power pump, the state placed two pumps at their disposal, making a charge sufficient to cover maintenance.

The City of Kalispell, Flathead County, and the City of Hamilton, Ravalli County, were each reported to be infested with the codling moth. Investigation showed that both infestations were of recent years. As these two cities were each in the center of commercial fruit districts, it was decided to make an effort to control the outbreak in these two towns. The City of Kalispell, through the influence of the State Board of Horticulture, purchased a high power spray pump and turned it over to the Board to operate. This was badly needed, not only for the fruit trees, but for the boulevard trees also, which were seriously infested with aphid. Elsewhere in this report is an article by Roy Roush, Horticultural Inspector for this district, in which he gives the results of his campaign for the control of the codling moth in Kalispell. See page 47. One pump is inadequate to cover the City of Kalispell, and one of the pumps now owned by the state which can be spared from another section should be placed in Kalispell.

In the City of Hamilton, six fruit growers who own small orchard tracts in the suburbs were induced to contribute toward the purchase of a high power pump for this town, which was also turned over to the State Board to operate. The extent of the codling moth in-

festation was greater than we knew, consequently there was not sufficient territory sprayed, and the results obtained, for this reason, were disappointing. We hope the coming season to put on a wider and more complete campaign, and shall make every effort to eradicate the moth from the City of Hamilton. No effort or expense should be spared in this work, as Hamilton is in the center of the largest fruit growing district in the state.

A power pump purchased by the City of Helena was placed in charge of H. S. Malcolm, green fruit inspector of that place, to operate. He reports good results obtained from its use.

Outside of the four cities mentioned, we had information of two other districts where the moth was present. One of these districts contained approximately 50 acres. A state owned pump was placed in this block under the supervision of Mr. A. E. Jones, one of our inspectors, with the result that from a very bad infestation the number of wormy apples and larvae found were reduced to the minimum, to be exact, 11 in number. The same plan followed the coming year should result in a complete eradication of the codling moth from this section.

The other district, known as Home Acres, contained an aggregate of 150 acres of orchard. We also placed a state pump on this work, under the supervision of Mr. W. L. Shovell, District Inspector. The trees were thoroughly sprayed twice and followed up with a system of banding. In this block, which was also badly infested in 1919, from all appearances the codling moth was completely eradicated. Not a wormy apple was found nor a cocoon of the moth under any of the bands. I do not believe it will be necessary to repeat the spraying program in this district next year.

Unfortunately, upon closer investigation, the past summer we found many other orchards infested with the codling moth, some to only a slight degree, while others to an extent that indicates the moth has been present for a number of years without the State Board having any knowledge of it. This makes it rather discouraging, for the reason that it is impossible for the state to supply sufficient pumps, and crews to operate them, to eradicate the moth from the Bitter Root valley. Consequently, if the work is done, and the State Board shall insist that it be done, it will have to be done by the owners themselves. Our present law is inadequate to force the spraying in every instance, and the only recourse we have where the owner refuses to spray is to do the work for him and charge the expense up as a tax against the

property. Unless we can have our law amended so as to impose a more severe penalty on those refusing to follow the advice of the Board, the codling moth will spread so that in a few years it will be present in every orchard in the Bitter Root valley.

The immense damage done each year by the codling moth, where it has become established in other states, and the cost to the grower in combating it would justify the state in taking extreme measures in an effort to eradicate it before it becomes thoroughly established. This, I believe, is possible, as it has been proven that the control of the codling moth in Montana is much easier than in some states where the seasons are longer and warmer and where several broods appear each year, while here we have but one and, perhaps, a partial second. Our cold winters as well as our short, cool summers also help to reduce its number. From a careful inspection of the trees in Missoula the past winter, it was found that practically all of the codling moth larvae that were above the snow line were winter killed, and, as the majority of them are found above the snow line, beneath the rough bark, the number of the first brood is greatly reduced.

PRODUCTION

Commercial apple growing in Montana has been established on a firm basis, the production this year being the largest in its history. There has been approximately 500 full cars marketed, with from 40 to 50 cars disposed of by local shipment. The returns for the apple crop this year were in excess of three-quarters of a million dollars. While other states of the northwest were meeting with difficulty in disposing of their apples at prices greatly reduced from that received last year, Montana McIntosh were in demand at prices equal to or higher than in former years. This condition has been brought about by the fact that there is only a limited area in the United States where the McIntosh can be successfully produced, and the greater part of the territory lies within the State of Montana. For this reason there is little fear of an over-production of the McIntosh, and the demand is increasing more rapidly than the production. Unfavorable varieties are rapidly disappearing and will be replaced by the McIntosh. This is shown by the fact that 80 per cent of all full car shipments from Montana this season were McIntosh Red. The establishing of permanent and profitable markets for the McIntosh apple will encourage the planting of new orchards, and Montana will eventually take a high place among the apple producing states of the Union.

INSECT PESTS

Insect pests and fruit diseases are being satisfactorily controlled. Those that have been present for a number of years have ceased to give us much concern. This has been brought about by the intelligent use of the spray pump. Thorough spraying at the right time with the right material will control all pests and the knowledge that clean fruit cannot be grown without a definite spraying program has resulted in a large increase in the number of spray pumps each year. On account of the invasion of the codling moth and leaf-roller, there will be a marked increase in the number of spray pumps purchased.

SPRAYING PROGRAM

The following spray program, if adopted by fruit growers, will insure clean fruit:

SPRAYING PROGRAM (From Circular 36, Montana Agricultural Experiment Station.)

MONTANA STATE BOARD OF HORTICULTURE

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Combinations to be sprayed for	I Dormant. Just before leaf buds open	II Just before flower buds open ("in the pink")	III When petals have nearly all fallen.	IV Two weeks later.	Notes. (At end of table).
Scab. Oyster-shell scale (or blister mite).	Lime-sulphur With no blister mite omit	Lime-sulphur	Lime-sulphur.	Lime-sulphur.	Note 4.
Scab. Green aphis (or woolly aphis)	Omit.	Lime-sulphur	Lime-sulphur, with tobacco extract.	Lime-sulphur.	Notes 1 and 4.
Scab. Codling moth (or bud moth)	Omit.	Lime-sulphur	Lime-sulphur, with arsenate of lead, 2 to 50.	Lime-sulphur, with arsenate of lead, 2 to 50.	Notes 2, 3 and 4.
Scab. Green fruit worm.	Omit.	Lime-sulphur, with arsenate of lead, 4 to 50.	Lime-sulphur.	Lime-sulphur.	Note 4.
Scab. Oyster-shell scale (or blister mite). Green aphis (or woolly aphis)	Lime-sulphur With no blister mite omit	Lime-sulphur	Lime-sulphur, with tobacco extract.	Lime-sulphur.	Notes 1 and 4.
Scab. Oyster-shell scale (or blister mite). Codling moth (or bud moth)	Lime-sulphur With no blister mite omit	Lime-sulphur	Lime-sulphur, with arsenate of lead, 2 to 50.	Lime-sulphur, with arsenate of lead, 2 to 50.	Notes 1 and 4.
Scab. Oyster-shell scale (or blister mite). Green fruit worm.	Lime-sulphur With no blister mite omit	Lime-sulphur	Lime-sulphur.	Lime-sulphur.	Notes 1 and 4.
Scab. Green aphis (or woolly aphis) Codling moth (or bud moth)	Omit.	Lime-sulphur, with tobacco extract.	Lime-sulphur, with arsenate of lead, 2 to 50.	Lime-sulphur, with arsenate of lead, 2 to 50.	Notes 1, 2, 3 and 4.
Scab. Green aphis (or woolly aphis) Green fruit worm.	Omit.	Lime-sulphur, with arsenate of lead, 4 to 50.	Lime-sulphur, with tobacco extract.	Lime-sulphur.	Notes 1 and 4.
Scab. Codling moth (or bud moth) Green fruit worm.	Omit.	Lime-sulphur, with arsenate of lead, 4 to 50.	Lime-sulphur, with arsenate of lead, 2 to 50.	Lime-sulphur, with arsenate of lead, 2 to 50.	Notes 1 and 4.
Scab. Oyster-shell scale (or blister mite). Green aphis (or woolly aphis) Green fruit worm.	Lime-sulphur With no blister mite omit	Lime-sulphur, with tobacco extract.	Lime-sulphur, with arsenate of lead, 2 to 50.	Lime-sulphur, with arsenate of lead, 2 to 50.	Notes 1 and 4.
Scab. Oyster-shell scale (or blister mite). Green aphis (or woolly aphis) Green fruit worm.	Omit.	Lime-sulphur, with arsenate of lead, 4 to 50.	Lime-sulphur, with arsenate of lead, 2 to 50, and tobacco extract.	Lime-sulphur, with arsenate of lead, 2 to 50, and tobacco extract	Notes 1, 2, 3 and 4.
Leaf roller and blister mite.	Miscible Oil				

ELEVENTH BIENNIAL REPORT

Scab.	Oyster-shell scale (or blis- ter mite). Codling moth (or bud moth) Green fruit worm.	Lime-sulphur. With no blis- ter-mite omit	Lime-sulphur, with ar- senate of lead, 4 to 50.	Lime-sulphur, with ar- senate of lead, 2 to 50.
Scab.	Oyster-shell scale (or blis- ter mite). Green aphis (or woolly aphis) Codling moth (or bud moth) Green fruit worm.	Lime-sulphur. With no blis- ter-mite omit	Lime-sulphur, with ar- senate of lead, 4 to 50.	Lime-sulphur, with ar- senate of lead, 2 to 50, and tobacco extract.
Oyster-shell scale (or blis- ter mite).	Green aphis (or woolly aphis)	Lime-sulphur. Omit.	Tobacco extract with soap.	Omit.
Oyster-shell scale (or blis- ter mite). Codling moth (or bud moth)	Lime-sulphur. Omit.	Arsenate of lead, 2 to 50.	Arsenate of lead, 2 to 50.	Note 1.
Oyster-shell scale (or blis- ter mite). Green fruit worm.	Green aphis (or woolly aphis) Codling moth (or bud moth)	Arsenate of lead, 4 to 50.	Arsenate of lead, 2 tc 50 with tobacco extract	Arsenate of lead, 2 to 50.
Oyster-shell scale (or blis- ter mite). Green aphis (or woolly aphis) Codling moth (or bud moth) Green fruit worm.	Omit.	Omit.	Omit.	Notes 1, 2 and 3.
Oyster-shell scale (or blis- ter mite). Green aphis (or woolly aphis) Codling moth (or bud moth) Green fruit worm.	Omit.	Arsenate of lead, 4 tc 50 with tobacco extract	Omit.	Notes 1, 2 and 3.
Oyster-shell scale (or blis- ter mite). Green aphis (or woolly aphis) Codling moth (or bud moth) Green fruit worm.	Omit.	Arsenate of lead, 2 tc 50 with tobacco extract	Omit.	Notes 1, 2 and 3.
Oyster-shell scale (or blis- ter mite). Green aphis (or woolly aphis) Codling moth (or bud moth) Green fruit worm.	Omit.	Arsenate of lead, 4 to 50.	Arsenate of lead, 2 tc 50 with tobacco extract	Notes 1, 2 and 3.
Oyster-shell scale (or blis- ter mite). Green aphis (or woolly aphis) Codling moth (or bud moth) Green fruit worm.	Omit.	Omit.	Arsenate of lead, 2 to 50.	Notes 1, 2 and 3.
Oyster-shell scale (or blis- ter mite). Green aphis (or woolly aphis) Codling moth (or bud moth) Green fruit worm.	Omit.	Omit.	Omit.	Notes 1, 2 and 3.
Oyster-shell scale (or blis- ter mite). Green aphis (or woolly aphis) Codling moth (or bud moth) Green fruit worm.	Omit.	Omit.	Omit.	Notes 1, 2 and 3.
Oyster-shell scale (or blis- ter mite). Green aphis (or woolly aphis) Codling moth (or bud moth) Green fruit worm.	Omit.	Omit.	Omit.	Notes 1, 2 and 3.
Oyster-shell scale (or blis- ter mite). Green aphis (or woolly aphis) Codling moth (or bud moth) Green fruit worm.	Omit.	Omit.	Omit.	Notes 1, 2 and 3.

Note 1.—If either kind of aphis appear later, spray with tobacco extract and soap. For treatment of the root form of the woolly aphis, see Circular 17, Mont. Agr. Exp. Station, page 128.

Note 2.—For discussion of the August spraying for the codling moth, see Circular 17, Mont. Agr. Exp. Station, page 137.

Note 3.—In case the bud moth, but not the codling moth, is present, the arsenate of lead in the spray applied two weeks after the petals fall may be omitted.

Note 4.—For discussion of a later spray for scab, see Circular 37, Mont. Agr. Exp. Station.

RESULTS OF USE OF SPRAY PUMP IN CITY OF KALISPELL

By ROY ROUSH, Inspector, Sixth District.

Through the influence of the State Board of Horticulture, the City Council of Kalispell was induced to purchase a high power spray outfit, which they turned over to the State Board to operate, with the results outlined below:

In presenting a report on the work of spraying the trees of this city during the past summer it may be well to recall their condition during the preceding summer before the spraying was done. By early August, 1919, the elms were very generally covered with elm tree aphis to such an extent that the leaves were yellow, unsightly and rapidly falling. The maples were suffering from the action of the maple leaf aphis, causing the syrupy "honey dew" covering the sidewalks and the discoloration and falling of the leaves. The injury to the maples is well shown by a tree on the City Hall grounds, which scarcely made a leaf this season as a result of the injury in 1919. These are but two of the many pests attacking our shade trees, but will serve as examples.

The present season was very unfavorable for an efficient control of pests, owing to the cold and rainy spring which delayed the trees in leafing out and making it difficult to spray at the right time, as some trees were in full leaf while others had scarcely broken the buds. Nevertheless, by care and repeated action, it was possible to effect an almost perfect control of the shade tree pests, and we take pride in calling your attention to the condition of the trees this year as compared to 1919.

Of the two pests mentioned above there was but a trace left in August and in no case were the trees so badly affected as to be noticeable without close search.

Since the trees of our streets and avenues are the finishing touch, without which these thoroughfares would be bare and unattractive, it has been aptly demonstrated that as an appreciation of civic beauty it certainly pays to spray. However, it must be emphasized that spraying unless carefully and conscientiously done by men thoroughly conversant with the pests and able to apply the RIGHT material in the RIGHT way and at the RIGHT time, is but useless expenditure of both time and money and must result in failure.

The City of Kalispell embraces about 280 blocks, sub-divided into 3360 lots 50x142 feet. There have been planted and stand at the present time 8882 fruit trees divided as follows:

6243	apple
1459	cherry
649	plum
531	pear

It is apparent that this number of trees would make an orchard of considerable size if spaced a distance of 30 feet apart.

There was sprayed this year, twice, 1688 trees in 352 lots in 56 blocks, at a cost of 30c per tree. This also includes banding and examination of bands and compares favorably with the cost of spraying a few years ago when the cost ran as high as 30c per tree. This I attribute in part to better spraying machinery, which was used this year.

The results of the spraying have been very satisfactory, as the following comparison shows: Out of a total of 114 lots sprayed, lying east of Third avenue, east and north of the Great Northern tracks, where the infestation was heaviest, 8 lots were found to be infested with the codling moth, numbering 19 larvae found in the apples and under the bands. Investigation seems to verify the belief that about 90% of these lots were infested last year. Out of 238 lots sprayed south of the Great Northern tracks and east of Main street, but three showed evidence of the codling moth.

In the unsprayed district, examination of the apples on the trees revealed 29 different lots infested with codling moth. These were banded and watched carefully and all wormy apples discovered on the trees were picked off and burned.

The greatest number of worms found on any one lot in the unsprayed portion was 67, the smallest 4, the aggregate 291, under bands and in the fruit.

It is quite unlikely that all the lots infested, in the unsprayed district, were found and this only emphasizes the importance of spraying a larger territory next year, in fact, the entire city, if we are to keep our orchards free of the codling moth. This brings up the question of equipment. It is an absolute impossibility to spray the entire city with one sprayer at the right time, and I would recommend that if the law and funds permit, we be equipped with another sprayer

of large capacity. With two sprayers it is possible to cover the entire town and at the right time.

A few conditions which tend to work against our best efforts might be mentioned here, the principal one being trees overhanging buildings and fences making it difficult to spray thoroughly and also allowing the worms places for hibernating, thus avoiding the bands; these, however, are a small minority. A more important condition is insufficient pruning, or none at all. This condition is quite general.

I hope to eliminate these conditions somewhat before another spraying season. In a few instances children tamper with the bands or remove them entirely.

I cannot close this report without a word of praise for the people of Kalispell for their co-operation and support in the spraying, the objectors being few and far between. I might also mention before closing that on 76 lots 211 trees were found to be infected with Fire Blight. Of this number approximately 90% were Transcendent crabs and Alexanders. These have been ordered removed and burned. Four mountain ash were also found to be infected. The oyster shell scale is quite generally distributed over the east half of the town, and cherries infested with worms were found on two lots.

The foregoing sets forth the cor ditions here at the present time.

MONTANA QUARANTINES

Montana has now in force three quarantines for the prevention of the introduction of diseases and pests. Quarantine No. 2 is against the white pine blister rust which is a fungus disease attacking the pines in the eastern part of the United States and causing serious damage. Our quarantine prohibits the introduction of any of the five-leaved pines, currant and gooseberry plants from any part of the United States east of and including Minnesota, Iowa, Missouri, Arkansas and Louisiana. There is a federal quarantine covering this same territory and also prohibiting the movement of the five-leaved pines and currant and gooseberry plants from infested territory into clean territory which gives us an additional protection against the introduction of this disease.

Quarantine No. 3 prohibits the introduction of the common barberry, both the green and purple form, which acts as the host plant for the black stem rust of wheat and which is necessary in carrying over the disease through one period of its life cycle.

The Sixteenth Legislative Assembly passed an act providing for the destruction of all harmful, or common, barberry bushes growing within the state of Montana. The work of eradication was placed with the State Board of Horticulture and under that authority the state has been scouted by our inspectors and all common barberry found has been removed.

Quarantine No. 4 was issued in 1918 for the prevention of the introduction of the alfalfa weevil. The quarantine was made effective against the entire state of Utah, the county of Delta in Colorado, the counties of Uinta and Lincoln in Wyoming and the counties of Bingham, Cassia, Bear Lake, Oneida, Bannock, Franklin, Power and Payette in Idaho, the areas known at that time to be infested with the alfalfa weevil. Prior to July, 1919, the state of Idaho also quarantined her infested counties but on that date the quarantine was annulled allowing shipments of hay from the infested counties to all parts of the state making it necessary for Montana to issue Quarantine No. 5 which was issued February, 1920, to become effective March 1, 1920. This quarantine prohibited the shipment of hay into Montana from the entire state of Idaho.

At the solicitation of some of the stockmen of the state who represented that there would be great suffering and heavy loss of the

livestock in the state by the excluding of Idaho hay, Governor Stewart extended the date of the enforcement of this quarantine to March 30th. At the expiration of the thirty days another extension of time was made, with a third extension to May 30, 1920.

At the present time it has become known that the alfalfa weevil has spread to twenty-two counties in Idaho, the counties of Gunnison and Montrose in Colorado, Washoe county in Nevada, and Malheur and Baker in Oregon. At the last meeting of the Quarantine Board, which is composed of the State Entomologist, the Commissioner of Agriculture and the State Horticulturist representing the State Board of Horticulture, it was recommended that the alfalfa weevil quarantine be extended to cover this new territory, and on December 30, 1920, Governor Stewart issued Quarantine No. 6, which included all territory known to be infested.

If the alfalfa weevil is introduced into the State of Montana it will result in a heavy loss to the alfalfa growers and a reduction of their crop. Everything possible should be done to prevent its introduction into Montana.

The State Board of Horticulture is doing everything within its power to enforce the requirements of our various quarantines. Shipments of all products coming under the quarantine regulations from alfalfa weevil infested sections are closely watched for by our inspectors and when found unaccompanied by the required certificates of inspection are returned to points of origin. All plants that might carry the white pine blister rust disease coming from the quarantined areas are destroyed as well as all common barberry plants.

QUARANTINES

Quarantine No. 2

WHEREAS, the fact has been determined that a dangerously injurious disease known as the White Pine Blister Rust (**Peridermium strobi** Kleb) exists and is prevalent in portions of the eastern part of the United States as far west as and including Minnesota; and

WHEREAS, there is danger of the introduction of this disease into the great white pine forests of the State of Montana through shipments of five-leaved pines and currants and gooseberry plants;

NOW, THEREFORE, I, S. V. Stewart, Governor of the State of Montana, under and by virtue of the authority conferred upon me by Chapter 61 of the Session Laws of the Thirteenth Legislative Assembly, do hereby declare and proclaim that a quarantine be and hereby is established against the importation into the State of Montana of white pine (**Pinus strobus**), stone pine (**P. cembra**), limber pine (**P. flexilis**) and any other five-leaved pines, and currant and gooseberry plants (**Ribes** and **Grossularia**) from any part of the United States east of and including the States of Minnesota, Iowa, Missouri, Arkansas and Louisiana.

All quarantine guardians and deputy state horticultural inspectors are hereby instructed and required to refuse admission into Montana of any shipments of any of the five-leaved pines above mentioned, and currant and gooseberry plants. It shall be the duty of the deputy horticultural inspectors, or other quarantine guardians, to deport immediately such shipments or destroy them by burning. All expenses incurred in deporting or destroying such shipments shall be paid by the consignor.

Any person who sells or offers for sale within the State of Montana pine seedlings, currant and gooseberry plants from the above quarantined area in violation of this quarantine order shall be liable to prosecution under the State Laws of Montana.

It is specifically understood and intended that this quarantine proclamation shall revoke all previous proclamations on this subject by me made.

IN WITNESS WHEREOF I have hereunto set my hand and caused the Great Seal of the State to be affixed.

DONE at the City of Helena, the Capital, this the third day of July, in the year of our Lord one thousand nine hundred seventeen.

(Signed) : S. V. STEWART.

By the Governor:

C. T. STEWART.

Secretary of State.

Quarantine No. 3

WHEREAS, the fact has been determined that a dangerously injurious plant disease known as Wheat Rust is disseminated and carried by means of Barberry bushes (**Berberis vulgaris**), both of the green and purple form; and

WHEREAS, there is danger of the introduction of this disease into the great wheat fields of Montana through shipments of said Barberry bushes and a further dissemination of said wheat rust through the agency of Barberry bushes;

NOW, THEREFORE, I, S. V. Stewart, Governor of the State of Montana, under and by virtue of the authority conferred upon me by Chapter 61 of the Session Laws of the Thirteenth Legislative Assembly, do hereby declare and proclaim that a quarantine be and hereby is established against the

importation into the State of Montana of Barberry bushes (**Berberis vulgaris**) and plants from any point without the said State of Montana.

All quarantine guardians and deputy state horticultural inspectors are hereby instructed and required to refuse admission into Montana of any shipments of Barberry bushes (**Berberis vulgaris**) or plants. It shall be the duty of the deputy horticultural inspectors, or other quarantine guardians to deport immediately such shipments or destroy them by burning. All expenses incurred in deporting or destroying such shipments shall be paid by the consignor.

Any person who sells or offers for sale, in the State of Montana, Barberry bushes (**Berberis vulgaris**) or plants contrary to this quarantine order shall be liable to prosecution under the laws of the State of Montana.

IN WITNESS WHEREOF I have hereunto set my hand and caused the Great Seal of the State to be affixed.

DONE at the City of Helena, the Capital, this the twenty-fourth day of April in the year of our Lord one thousand nine hundred eighteen.

(Signed) : S. V. STEWART.

By the Governor:

C. T. STEWART,
Secretary of State.

Quarantine No. 6

Whereas, It has become known to me that an injurious insect, popularly called the alfalfa weevil, and scientifically known as "**Phytonomus posticus**," exists and is dangerously injurious to alfalfa in the States of Utah and Idaho; in certain counties in the State of Wyoming, to-wit: Uinta and Lincoln counties; in certain counties in the State of Colorado, to-wit: Delta, Gunnison, and Montrose counties; in a certain county in the State of Nevada, to-wit: Washoe county; and in certain counties in the State of Oregon, to-wit: Malheur and Baker counties:

NOW, THEREFORE, I, S. V. Stewart, Governor of the State of Montana, under and by virtue of the authority conferred upon me by Chapter 61 of the Session Laws of the Thirteenth Legislative Assembly, do hereby declare and proclaim a quarantine against said States of Utah and Idaho; against the counties of Uinta and Lincoln in the State of Wyoming; against the counties of Delta, Gunnison and Montrose in the State of Colorado; against the county of Washoe in the State of Nevada; and against the counties of Baker and Malheur in the State of Oregon, and forbid the importation into Montana of the following agricultural products and other articles, excepting under conditions and regulations as herein specified:

1. Alfalfa hay and other hays of all kinds and cereal straws, **excepting** the material known locally in Utah as salt grass packing hay, which shall be admitted into Montana, provided that such material be cut only between the dates of October 1 and April 1, and that the raking, shocking, stacking, baling and shipping of this material as a commercial product be conducted only after the maximum daily temperature of the season has fallen below sixty degrees Fahrenheit.

Provided, further, That a certificate be required from the Crop Pest Inspector of the State of Utah showing that these requirements have been met, which certificate shall accompany each shipment.

Provided, further, That no salt grass packing hay shall be held over in the field from one season to another. The use of salt grass hay as a packing material in shipments of fruit, crockery and other materials is permitted, provided said salt grass hay has been cut and removed from the field between October 1 and April 1, as above specified, and

stored in warehouses removed from alfalfa fields, alfalfa hay or other suspected materials.

Excepting, further, That alfalfa meal or other finely ground meals made from alfalfa hay may be shipped from the above designated quarantined states and counties into the State of Montana under the following regulations:

Mills desiring to ship such products into Montana shall apply to the State Horticultural Inspector of Montana for a permit. Such permits shall be issued only to owners or operators of mills located on land free of and remote from growing alfalfa. The Horticultural Inspector of Montana, before issuing such a permit, shall satisfy himself that such alfalfa milled products, if not shipped at once after grinding, have been stored in warehouses remote from growing alfalfa and free from alfalfa hay, and the hauling of the hay to the mills and the grinding of the meal has been done only between the dates of October 1 and April 1.

Violation of any of the provisions in these regulations governing the shipment of alfalfa mill products into Montana shall be cause for the revocation of such permits.

2. Fresh fruits and vegetables, exclusive of potatoes, excepting under the following regulations:
 - a. Shipments for Montana to be made only from points designated by the recognized State Pest Inspection officers of the State shipping into Montana, said officers to notify the State Horticulturist of the State of Montana by registered mail or by telegraph of the designation of all shipping points in the aforesaid States of Utah and Idaho; and counties of Uinta and Lincoln in Wyoming; and counties of Delta, Gunnison and Montrose in Colorado; and county of Washoe in Nevada; and counties of Baker and Malheur in Oregon; said notification to be sent and its receipt to be acknowledged before any shipments are made to the State of Montana from said designated points.
 - b. Shipments to be repacked from orchard or field boxes into new, clean boxes, or other fresh containers.
 - c. All wagons or other conveyances used in hauling to the place where repacking is conducted to be kept free from alfalfa hay or other hays, straw, and all other means of contamination.
 - d. All packing houses to be at all times free of alfalfa hay, other hays, straw, and other means of contamination.
 - e. Each lot shipment shall bear an official certificate of the state from which the shipment originates stating that it has been inspected and passed in compliance with these regulations and stating where it was repacked and inspected.
3. Potatoes unless accompanied by an official certificate signed by the recognized State Pest Inspection Officer of the State from which such shipments of potatoes originate, setting forth that the potatoes have been passed over a screen, placed in fresh, clean sacks and packed in cars that are free of alfalfa hay or other means of contamination.
4. All nursery stock, unless accompanied by special certificate setting forth that such nursery stock has been fumigated for the alfalfa weevil in an airtight enclosure subsequent to being boxed, baled or packed for shipment, with cyanide of potassium or cyanide of sodium at the rate of one ounce to each one hundred cubic feet of enclosed space.
5. That no shipment of household or emigrants' movables originating in any state or county designated as infested with the alfalfa weevil shall be brought into the State of Montana by any common carrier, person or persons, unless such shipment be accompanied by a copy of a sworn statement made in duplicate by the owner or shipper after the follow-

ing forms on blanks which will be furnished to applicants by the State Horticulturist of Montana, Copy No. 1 to be mailed to the State Horticulturist, Missoula, Montana, and Copy No. 2 to be delivered to the common carrier agent, with a special certificate appended, to attach to waybill.

State of } ss.
County of

I hereby solemnly swear that I was present during the preparation for shipment of the household or emigrants' goods which this affidavit accompanies; that the goods were delivered to the at on
 (Railroad) (Station)
 constituting (less than) a carload
 (Month, day, year)

(If carload, write initials and car No. here)
 to be shipped to (Name of consignee)
 at via

(Destination) (Give initials of other lines)
 that no nursery stock, vegetables or fruit is included in the shipment and that no hay or straw (except as provided for under Part No. 1 of this Quarantine) is included for packing material, or any other purpose, except as food necessary for the livestock in transit to the Montana state line; that the shipment is made up of the following: Household goods, farm implements, tools, harness, farm wagons, automobiles, stands of bees, livestock (draw a line through items not included)

(Specify)
 feed for animals in transit (Specify kinds and amount of each)
 and (Specify any items not included in previous classification)

(Shipper or owner)
 Subscribed and sworn to before me
 a Notary Public in and for the State of
 County of this the day of
 , 19.....

(Notary Public)
 My commission expires , 19.....

The special certificate from the owner or shipper to be appended to Copy No. 2 of the sworn statement shall be after the following form:

I hereby agree to observe explicitly the requirements of the Montana Quarantine Order with regard to hay or straw (included as stock feed for use before reaching the Montana state line), household and emigrants' goods and other materials, and hereby certify that I have mailed this day one copy of the foregoing affidavit to the State Horticulturist, Missoula, Montana.

(Signature)

6. All railway shipments of livestock unless shipped in cars that are free of alfalfa hay, all other hays and cereal straws, throughout all that portion of the journey that is within the States of Utah and Idaho; the

counties of Uinta and Lincoln in Wyoming; the counties of Delta, Gunnison and Montrose in Colorado; the county of Washoe in Nevada; and the counties of Baker and Malheur in Oregon.

All Horticultural Inspectors of the State of Montana are hereby instructed and required to refuse admission into the State of Montana of all such articles as are herein designated from said States of Utah and Idaho; and counties of Uinta and Lincoln in Wyoming; and counties of Delta, Gunnison and Montrose in Colorado; and county of Washoe in Nevada; and counties of Baker and Malheur in Oregon, except under the conditions herein enumerated. If any such articles as are hereinbefore listed be shipped into the State of Montana in violation of this Quarantine they must be at once destroyed or returned to the shipper at his expense.

This Quarantine shall not be construed to interfere with shipments of products to the Yellowstone National Park over the Oregon Short Line Railroad, and to Idaho points via Montana over the Gilmore and Pittsburg Railroad.

This Quarantine shall take effect and be in force on and after the first day of January, A. D. 1921.

It is specifically understood and intended that this Quarantine Proclamation shall revoke all previous Proclamations on this subject by me made.

IN WITNESS WHEREOF, I have hereunto set my hand and
(Seal) caused the Great Seal of the State to be affixed.
DONE at the City of Helena, the Capital, this
the thirtieth day of December, in the year of our
Lord one thousand nine hundred and twenty.

S. V. STEWART.

By the Governor:

C. T. STEWART,
Secretary of State.



